

Redwood

National and State Parks

National Park Service
US Department of the Interior

Department of Parks and Recreation
State of California

2011 HERD UNIT CLASSIFICATION OF ROOSEVELT ELK



Photo: Redwood National Park

March 8, 2012

INTRODUCTION

The Roosevelt elk (*Cervus elaphus roosevelti*), the largest of the six recognized subspecies of elk, once occurred from southern British Columbia south to Sonoma County, California. The tribes living in and around what is now Redwood National and State Parks (RNSP or “parks”), the Tolowa, Yurok, Hupa, and Chilula, burned the prairies of the Bald Hills and other forest openings regularly in part to promote the growth of new grass attractive to wildlife (i.e., elk and deer); their use of elk for subsistence presumably had minimal impact on elk populations. With the arrival of European and other foreign settlers intense hunting began in the mid-1800s and the Roosevelt elk’s range was highly reduced. In 1848 through 1855 market hunting for elk hide and meat supplied gold miners during the northern California gold rush. When the gold rush was over a large amount of elk habitat was converted to cattle and sheep ranching and croplands, and elk were killed to protect against crop depredation. Elk populations and distribution in the Marble and Siskiyou Mountains and the Salmon-Trinity Alps were significantly reduced (USDI 1983). The only Roosevelt elk populations that persisted through this period were those occupying coastal lowlands in the northern part of California, where dense forests and brush fields provided protective cover. Today Roosevelt elk in California persist only in Humboldt and Del Norte Counties, and extreme western Siskiyou County.

Dasmann (1964) speculated that the total elk population of northern California ranged from 1,000 to 2,000 animals at that time. Mandel and Kitchen (1979) estimated the elk population then to be 1,000 to 1,300, with roughly half being located in and around RNSP. Elk currently occur in the redwood forest, oak woodlands, grasslands, and coastal dunes in RNSP and the surrounding areas.

Work in RNSP

Annual classification of elk herds within RNSP began in 1996 to document relative abundance and simple population characteristics, such as cow numbers, recruitment, and calf survival within known herds (Wallen 1997). These herd count/classifications have been conducted annually each fall since that time. Also in 1996, a monitoring program of the elk population in a portion of the Prairie Creek drainage was established independent of the RNSP program (Weckerly 1996, Weckerly et al. 2004). The 2 independent monitoring programs in the same area provided a unique opportunity to compare data gathered unsystematically with data gathered using a science-based approach using a standard protocol.

In 2004 the “Weckerly method” (Weckerly and Francis 2004) of counting elk in the Bald Hills was implemented for the first time by Dr. Weckerly. Unlike the Prairie Creek herd counts which were quite similar between the 2 data collection methods, the Bald Hills herd counts were very dissimilar between the 2 methods, with park staff counts grossly undercounting the numbers of animals. Due to the inaccuracy of the park staff counts, the park discontinued fall counts in the Bald Hills in 2008.

METHODS

Seven separate herds were counted/classified within RNSP. Six of the herds were counted by RNSP staff between early September and mid-December 2011, with the exception of one herd that was counted just once during the “fall” period, in early January 2012. The Bald Hills herd was counted 10 times in January 2012 by Dr. Weckerly. Surveys associated with the Prairie Creek herd monitoring program, conducted by Dr. Weckerly, also were conducted in January. Results from these latter two surveys are considered part of the 2011 elk count “season” and are included in this report with the fall 2011 data. This is compatible with how information was reported in previous reports.

Fall classification counts were conducted by driving or hiking to the identified herd units. Using binoculars and spotting scopes, RNSP staff recorded the total number of elk observed, and the total number of elk within each classification group. The groups are mature bulls, spikes (first year males identified by a lack of brow tine off the main beam), cows, and calves. The observers also assigned ranking criteria to the classification counts that specified the observer’s confidence in the accuracy of the count. A scale of 1 to 4 was used to determine the certainty of the observation. A rating of 1 indicated good visibility and the animals were close enough to accurately count and classify the herd. A rating of 4 indicated that the observation was unacceptable for determining herd composition because of poor visibility due to low light level, fog, vegetation, or topography. In calculating the ratio of calves to adult cows, ratings of 3 and 4 were dismissed due to poor quality of observations. As in previous years, the highest cow counts with an acceptable ranking were used as the herd size estimates for 2011. The counts from the fall period were used, even though more animals may have been observed during earlier months.

Elk in the Bald Hills during winter surveys were counted from vantage points or approached on foot and counted. A set route was driven/walked once a day 10 times. When groups were approached on foot it was to obtain an unobstructed view or to conduct a coordinated stalk. A coordinated stalk consisted of an attempt to alert elk groups to the presence of one surveyor in such a manner that the group walked to an area with an unobstructed view where they could be counted by another surveyor. All elk seen were counted and classified as mature bulls or “cows” using binoculars and field telescopes. Juveniles and spikes were combined with female counts because these age-sex classes were not detected by themselves in separate groups. All animals within 50 m of one another displaying coordinated activity or movement were considered a herd (Weckerly et al. 2004). As with the other herd counts, the highest reliable cow count was used as the year’s herd size estimate for this season.

Fall Count Herd Units

- (1) **Old South Operations Center (OSOC)** herd
- (2) **Lower Redwood Creek (LRCR)** herd (sometimes referred to as the “Levee” herd in previous reports)
- (3) **Davison Ranch/Berry Glen (DARA)** herd
- (4) **Elk Prairie/Hwy 101 Bypass** herd (EPBY)
- (5) **Gold Bluffs Beach (GOBB)** herd(s); (several co-mingling herds)

(6) **Crescent Beach Education Center (CBEC) herd**

Fall Count Herd Classification Groups

- **Cows** = all females >1 year old.
- **Calves** = young of the year (<1 year old; recognized by spotted coat and small size; later the spots disappear, but they retain a short, rounded snout).
- **Spikes** = year old males exhibiting only a main beam, brow tine absent.
- **Mature bulls** = ≥ 2 years, with brow tine evident off the main beam.

Fall Count Herd Observation Ranking Criteria

- 1 = Good**, visibility good and animals close enough to observe with high confidence of an accurate count and classification.
- 2 = Fair**, animals are either distant or not fully cooperative for good confidence in classification (e.g. some vegetation blocking full view or movement into cover while counting).
- 3 = Poor**, animals too far away (e.g. difficult to track individuals or animals are in adjacent hiding cover).
- 4 = Unacceptable**, bad visibility due to low light levels, fog, uncooperative animals.

All of the ranked observations are briefly summarized in the notes section of the data form.

RESULTS AND DISCUSSION

Fall classification counts (and winter 2012 for Bald Hills) for the different age classes are presented in Table 1. It should be noted that the parks' DARA and EPBY herds are combined in Weckerly's "Prairie Creek" herd. Table 1 numbers for DARA/EPBY reflect fall staff counts.

Table 1. Highest number of elk reported within each herd unit and for each classification grouping in 2011. MB = mature bull, SP = spike, CW = cow, CV = calf, n = total counts.

Location	MB	SP	CW	CV	Total	n
OSOC	2	0	12	2	16	7
LRCR	4	4	18	8	34	4
Bald Hills	15	N/A	241	N/A	256	10
DARA	10	1	21	8	40	6
EPBY	9	0	0	0	9	6
GOBB	1	2	16	7	26	4
CBEC	2	2	28	4	36	1 ¹

¹ This herd was counted once during the "fall" count period, on January 6, 2012. A count on 8/27/2011, the most recent count to the one in January included 1 bull, 5 spikes, 27 cows, and 12 calves for a total of 45 animals.

In 2011 Weckerly's estimate for the Davison herd was 46 elk, including bulls at Boyes Prairie (F. Weckerly pers. comm.). The staff count for these two herds was 49, once again illustrating that total herd count numbers between the 2 methods are highly comparable.

Cow counts by year, the best indicator of herd persistence (McCullough et al. 1994, Weckerly and Francis 2004), are displayed in Fig. 1. Numbers for all herds for all years are provided in Appendix A. The OSOC, LRCR, and GOBB cow counts increased somewhat over last year's, however, the Davison cow count decreased substantially as did the CBEC count, although the latter may have been an artifact of a small sample (1 count). There were no cows counted in the EPBY herd for the second consecutive year; no cows were recorded in the January counts (F. Weckerly pers. comm.). Only one cow was observed on one occasion in the EPBY herd in 2011. The GOBB herd ranges widely over a large area and is difficult to count so this number should be taken with caution, although the substantial decline, and persistent lower numbers since 2002, likely indicate a real trend. The Bald Hills herd count was up this year from its low number in 2010, and more in line with what's been recorded in other previous years.

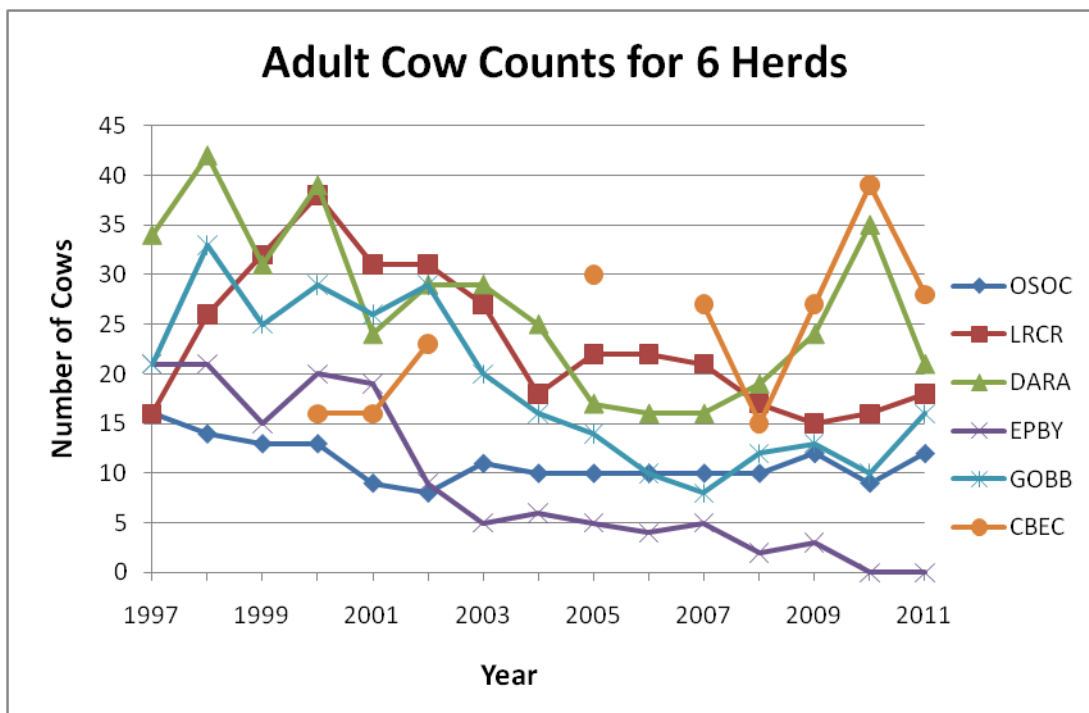


Figure 1. RNSP fall elk herd cow numbers from 1997 to 2011 indicating herd persistence through time. The CBEC herd counts did not begin with regularity until 2007.

The highest fall cow count in each herd was used to determine calf:cow and bull:cow ratios. The ratio of calves to cows is an indication of herd productivity; ratios were up from last year's counts in 2 herds, and down in 4 (Table 2). The low calf:cow ratio for the CBEC herd in 2010 was thought to have been an artifact of the low number of counts that year compared to other years. However, the one count in 2011 (January 2012) indicated a calf:cow ratio almost 3 times

that of 2010, indicating that 2010 may indeed have been a low year for calf productivity or survival for the CBEC herd. The high calf:cow ratios in 2004, 2007, and 2008, and to a lesser extent in 2009, for the EPBY herd were artifacts of an extremely small population size. In 2011, for the second year no cows or calves were observed in that herd during fall and winter counts. Weckerly (unpub. data) calculated a calf:cow ratio of 0.29 for the DARA herd. The staff fall count data indicated a calf:cow ratio of 0.38. Weckerly and Francis (2004) found that herd counts in the Prairie Creek drainage were similar from 1997 to 2003 between staff counts and their's, but herd composition ratios were not. Weckerly and Francis (2004) suggested this may be due to observer bias in classifying calves.

Table 2. Calves per 100 cows for fall elk herd counts, 1997 to 2011 (N/A = data not available).

Herd	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
OSOC	35	29	31	15	22	36	27	10	40	30	40	40	25	55	16
LRCR	11	15	38	22	26	22	11	22	18	45	33	23	20	56	44
DARA	27	18	23	41	29	21	21	24	12	18	56	37	33	22	38
EPBY	33	24	53	29	37	33	20	50	0	25	60	100	33	0	0
GOBB	38	12	7	9	19	21	15	6	17	30	50	50	54	60	44
CBEC	N/A	N/A	N/A	13	12	22	N/A	N/A	N/A	N/A	30	40	30	5	14

One reason for monitoring bull:cow ratios is that these ratios may indicate the quantity of available forage. That is, when food is less abundant males may use habitats where they are more difficult to observe, in part due to social demands unique to males of polygynous species (Weckerly et al. 2004, Weckerly 2007). Figure 2 displays the bull:cow ratios for the 6 herds monitored in the fall by park staff. There are no data displayed for the EPBY herd due to only bulls being present. Instead, these bulls were included with the DARA herd ratio, as did Weckerly; he reported a bull:cow ratio of 0.58 for the DARA herd. This was much lower than the 0.90 bull:cow ratio for the fall staff counts. This high ratio is likely the result of the 9 bulls observed in the EPBY herd during one of the fall staff counts. When the 9 bulls from Elk Prairie are removed from the calculation the staff bull:cow ratio for the DARA herd was 0.48, substantially lower than Weckerly's estimate.

The cause of the discrepancy between bull:cow ratios between staff counts and Weckerly's counts is not understood, but may be due to differences in methodology between the 2 counts. Ratios from staff counts are based on actual numbers of animals observed, while Weckerly accounts for imperfect detection, and bulls typically have lower sighting probabilities than cows. Thus, Weckerly's bull:cow ratios account for the differences in sighting probabilities between the sexes, which may explain why staff ratios have been consistently lower (F. Weckerly pers. comm.).

The OSOC herd bull:cow ratio showed a decrease after increases for the 3 years in a row; the LRCR ratio was comparable to 2010's; the GOBB ratio declined to near zero (only 1 bull observed on all counts), and the CBEC ratio also was at a low comparable to 2010.

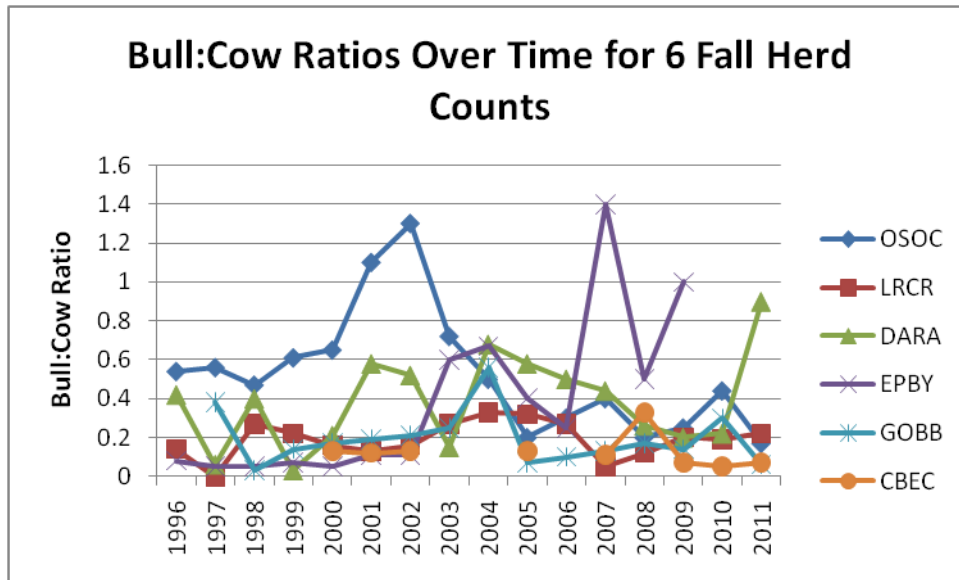


Figure 2. Bull:cow ratios from 1996 to 2011 indicating herd reproductive capability through time. The CBEC herd was not counted consistently every year.

Old South Operations Center (OSOC) Herd

The cow count for the OSOC herd was back up to a more typical number for this herd, after the high count in 2000, and after dropping to 9, the second lowest number counted, last year in 2010. Calf production was poor with only 2 out of 12 cows with calves. The bull number remained low, at 2. Reasons for this are unknown; perhaps forage quantity has changed over the years, forcing bulls into habitat where they are less likely to be observed (Weckerly 2007). The annual Northwestern Elk Hunt, which includes private property in the Orick Valley, took at least one bull from this herd in 2011 (see *Annual Elk Hunts* below). It is not known for certain whether or not California Department of Fish and Game issued any elk depredation permits to any of the Orick landowners, but this was unlikely to have occurred in 2011 (D. Lancaster, pers. comm.)

Lower Redwood Creek (LRCR) Herd

This elk herd uses a long corridor of habitat along lower Redwood Creek extending from the private land pastures near the Redwood Creek estuary, upstream to the Tall Trees Grove. As in 2010, this herd also frequented the southeast side of the ephemeral pond adjacent to U.S Highway 101, across from the O-Req picnic area on Freshwater Beach. In 2011, this herd also was observed on Freshwater Spit and on one morning (8/30) was seen swimming across the north end of Freshwater Lagoon from west to east. They stayed on the east side of the lagoon for a couple of days, where mowed lawns extend to near the lagoon's edge. The cow count was similar to what it's been in the previous 4 years but has yet to regain the high numbers observed in the late 1990s and early 2000s (Fig. 1 and Appendix A). The calf:cow ratio was fairly high for the second year, although not as high as last year when over half the cows produced calves. The bull:cow ratio was up slightly from last year. The Northwestern Elk Hunt may remove animals from this herd on private ranchlands in and around the Orick Valley.

Davison Ranch (Elk Meadow) / Berry Glen (DARA) Herd

This herd consists of a group of mature bulls that often occupies the northern portion of Elk Meadow north to the Lost Man Creek Hatchery, and a group of cows, spikes, and calves that occupy the southern portion of Elk Meadow south to Skunk Cabbage Creek. These animals also frequent the Redwood Adventures cabins and the Valley Green Office (Green Diamond Resource Co.) on the east side of the highway, due to the fresh mowed grass at these locations. The number of cows counted (21) was similar to last year's count (23), but as in the LRCR herd, numbers of animals have dropped from the high numbers observed in the late 1990s and early 2000s. The calf:cow ratio was up substantially at 0.38 over last year's 0.22. The bull:cow ratio was inflated to 0.90 due to the inclusion of the Elk Prairie (Boyes Prairie) bulls. Without including these animals the ratio was 0.48, similar to ratios observed in 2006 and 2007.

Elk Prairie / Hwy 101 Bypass (EPBY) Herd

On June 15, 8 bulls were observed with one cow in Elk Prairie. At no other time during the year were cows recorded, and Weckerly did not observe any cows at this site in 2012 (F. Weckerly pers. comm.). The highest number of bulls observed during any one time in 2011 was 9. Weckerly believes this herd is "extinct" or on the very verge of extinction (F. Weckerly pers. comm.). The herd has been dwindling steadily since 2001. Explanations for this may be due to the Hwy 101 bypass where the California Dept of Transportation (Caltrans) planted grass along the shoulders, thus, increasing likelihood of vehicle collisions, along with median barriers that also may increase the likelihood of collisions. The remoteness of the area makes it more accessible to poachers, and the freeway may have altered herd movements. Apparently the quality of the forage at Elk Prairie, despite the lack of prescribed burning, is superior to that of the Davison Ranch area where elk persist (F. Weckerly pers. comm.).

Gold Bluff Beach (GOBB) Herd

The GOBB herd is comprised of several sub-herds that come together on occasion. They use a large area that extends from Mussel Point at the south end of Gold Bluffs Beach to Carruther's Cove near the northern limit of this beach. This year 4 fall counts were attempted, and animals were observed on 3 of them, the one with the highest count occurred during a snowy plover survey. This is a difficult herd to count because of the large area they use and the brushy nature of the coastal bluffs which can obscure some animals. Due to these factors it's possible the counts under-represent the total herd number to some degree, but don't account for the fact that cow numbers have declined substantially and remained relatively low since 2003. (This despite increased regular traversal of the beach for snowy plover surveys.) However, in 2011 there were 16 cows recorded, up from the 10 seen in 2010. Sixteen was the highest count since 2004 when 16 animals also were counted (see Fig. 1 and Appendix A). The calf:cow ratio was 0.44, the lowest since 2006 when the ratio was 0.30. The bull:cow ratio was very low at 0.06; only 1 bull was observed on each of the 3 counts when animals were seen. It is possible that some animals in this herd are impacted by the Klamath Elk Hunt.

Crescent Beach Education Center (CBEC) Herd

Interpretation staff stationed at CBEC recorded elk in the meadows near CBEC throughout much of the year. However, the last count in 2011 was on August 27, when 45 animals were counted. Since this is technically outside the fall count window, the count in early January was used in this report. The “2011” count was down to 36, with 28 cows, falling short of the 39 cows counted last year (and 33 counted in August of this year). However, the numbers are in line with previous year’s counts. Calf numbers also were high earlier in the year (10-14), however, the one count on January 6 only detected 4, thus the calf:cow ratio was low at 0.14. The bull:cow ratio also was low (0.07) due to one bull in the count in January. This was the case throughout the year when just 1 or 2 bulls were recorded.

Bald Hills Herd

There were 10 consecutive counts in the Bald Hills in 2012, from January 5 to January 14. This year, the high count for the Bald Hills herd was 250 (241 cows and 9 bulls), up from the record low of 227 in 2010. There also was a subgroup of 6 bulls recorded in Dolason and Elk Camp Prairies during this time. Other than this separate group of bulls, no Bald Hills sub-herds were observed this year; elk counted in the Bald Hills were always in one large group, using the area between Lyons Ranch and Stover Ranch (private land bordering the national park boundary to the east). Due to the lumping of cows, calves, and spikes into the “cow” group, calf:cow and bull:cow ratios were not calculated for this herd.

Winter survey routes in the Bald Hills were displayed in previous Annual Elk Reports.

Other Observations

There were 73 opportunistic staff observations and 2 visitor reports of elk recorded in the Wildlife Observation database. Twenty-five of these observations were of the CBEC herd, which is known to cross Hwy 101 at the base of Crescent City Hill and uses the meadows on the east side of the road. Sixteen records were of animals in and around the North Operations Center; bulls have been frequenting this location, and a herd may be in the process of developing at this site although no females have yet to be observed with any frequency. A number of reports were from a staff member who lives near Elk Valley Road in Crescent City, these animals were generally on the border with Jedediah Smith Redwoods State Park, or just outside the park. There also were a number of reports of elk at Stone Lagoon and Big Lagoon, however, these records are not included here.

Incidents

On October 26, 2011 there was one noteworthy elk incident, involving a herd consisting of approximately 15-20 animals, cows with large yearling calves, and one bull. Two men were hiking on the Friendship Ridge Trail in Prairie Creek Redwoods State Park, making a loop from the Coastal Trail around to the Fern Canyon Trail and down to the beach/parking lot. Just before they reached the junction of the Friendship Ridge Trail and James Irvine/Fern Canyon Trails

they came upon the GOBB herd, which was in the trail, blocking their way. The calves “false charged” the men, forcing them off the trail, then returned to their mothers. Both men were frightened and didn’t want to move, however, eventually they continued their hike. They soon came upon the bull along with 8 cows and their calves. The whole group then moved together above the trail approximately 30-40 yards away into the forest and the men continued to their vehicle. By this time it was near dark, and as they were driving out on Davison Road they encountered 2 people on foot approximately 0.5 mi past the entrance kiosk. They flagged down the men in the vehicle and stated they had been frightened off the trail by “very aggressive” elk. Another 0.5 mi farther along the road 3 more people were walking who stated that they, too, had encountered the herd while enroute on a trail back to Elk Prairie Campground. They had bushwhacked their way to the road to avoid the elk.

Mortality

There were 4 known elk deaths (from other than hunting) in RNSP in 2011. On March 5 a national park employee stationed at the Wolf Creek Education Center notified NPS law enforcement that there was an elk carcass in a vehicle turnaround area on the Wolf Creek access road. This area is in front of the Wolf Creek gate, not far from the junction with Newton B. Drury Parkway. The hind legs, backstrap, and one front leg had been removed. It also had 4 feet of chain wrapped around its neck and appeared to have been dragged as skin, hair, etc. also was missing. At first this was assumed to be a poaching event, however upon further inspection by a state game warden, it was determined there was no bullet entrance or exit wound. More cord was found nearby on the Parkway, and it was evident that the animal had been dragged to its location, and the body parts removed, probably after having been struck by a vehicle.

On May 27 a worker at the Valley Green Office north of Orick reported a dead cow elk at the site of the former Rolf’s Restaurant near Hwy 101 and Davison Road. He believed, based on her appearance, she may have died giving birth. However by the time the wildlife biologist and ranger arrived 1/2-hour later, the animal had been taken away. Tire tracks were visible in the wet grass and we could see where the animal had laid. The next day, May 28, a law enforcement ranger found a partial carcass with nearby vehicle tracks in the bushes near the bridge over Prairie Creek on Davison Road. It is not certain how this animal died, but it was assumed to be a different animal than was reported the day before, as it was in a more advanced state of decomposition. There was a report of an elk struck by a vehicle on June 23, near milepost 129 on the Hwy 101 bypass. But again, by the time law enforcement rangers arrived on the scene the carcass had been scooped up and taken away.

Annual Elk Hunts

Two local elk hunts may impact RNSP elk herds. The Northwestern Hunt is on all lands in Del Norte and Humboldt Counties that are not Green Diamond Resource Company or park lands. The Northwestern Hunt may cause hunting pressure in the Orick Valley (OSOC, LRCR herds) and in the north (e.g., CBEC herd). The Klamath Hunt may take animals from the Bald Hills herd and possibly the GOBB herd. Three bulls were taken from the Orick Valley in 2011. It is

believed that a bull taken from the OSOC herd was the alpha bull, and one bull was removed from the LRRCR herd. It's unclear from which herd the 3rd bull was taken in the Orick area. The Klamath Hunt took 1 cow and 2 bulls in the vicinity of Skookum Prairie near Schoolhouse Peak and 2 bulls were taken in the vicinity of Olgatree Road across from Childs Hill Prairie (CDFG unpub. data).

Summary and Opportunities for Research

Based on count numbers, RNSP elk productivity was down in 3 herds (OSOC, LRRCR, and GOBB), and up in 2 herds (DARA and CBEC) compared to 2010. Cow counts indicated, however, that overall animal numbers were comparable to most of the previous 5 years, with the exception of the EPBY herd that had no cows present during counts for the 2nd year in a row.

In the advent of global climate change, there is a need to determine how climatic variables (e.g., summer fog frequency and intensity, onset and duration of winter rains) and demographic parameters (e.g., abundance and productivity) of Roosevelt elk influence primary production of grassland habitats within RNSP. A proposal was recently prepared by researchers at USGS to 1) conduct a retrospective analysis to examine relationships between grassland Normalized Difference Vegetation Index (NDVI) values (determined from Landsat imagery), climate variables, and elk demography and distribution data over a 15+ year time span (1996 – present), and 2) conduct field measurements to quantify how different levels of elk herbivory affect grassland nitrogen cycling and above-ground productivity. This proposed study is directed towards achieving NPS Climate Change Strategy goals, and would examine potential causes of decline of certain elk herds within RNSP. Results from this type of research would enable managers to better understand and convey to the general public how climate change may interact with fluctuating populations of large herbivores and grassland habitats that are integral components of redwood forest ecosystem processes (M. Ricca pers. comm.).

Report Prepared by Kristin Schmidt, RNSP Wildlife Biologist

LITERATURE CITED

- Dasmann, R. F. 1964. Big game of the redwood forest region. Report for National Park Service, Coast Redwood study, Contract #NPS-WASO-11-63(4). 54pp.
- Mandel, R.D. and D. W. Kitchen. 1979. The ecology of Roosevelt elk in and around Redwood National Park. Report for the National Park Service, Contract PX 8480-8-0045. 69pp.
- McCullough, D.R., F.W. Weckerly, P.I. Garcia, and R.R. Evett. 1994. Sources of inaccuracy in black-tailed deer herd composition counts. *Journal of Wildlife Management* 58:319-329.
- USDI [U.S. Department of the Interior]. 1983. Elk live trapping and relocation environmental assessment. Redwood National Park, Arcata, California. 11pp.
- Wallen, R. L. 1997. Monitoring abundance and distribution of Roosevelt elk in 1996 in Redwood National and State Parks. Annual project report, Resource Management and Science Division files, Orick, CA. 6pp.
- Weckerly, F.W. 1996. Roosevelt elk along the Prairie Creek drainage: an evaluation of estimating abundance and herd composition. *California Fish and Game* 82:175-181.
- Weckerly, F.W. 2007. Constant proportionality in the female segment of a Roosevelt elk population. *J. Wildl. Mgmt.* 71(3): 773-777.
- Weckerly, F.W. and D.R. Francis. 2004. Elk in north coastal California: habitat suitability, sign survey utility and population monitoring. Dept. of Biology, Texas State University, San Marcos, Texas. Unpub. Rept. on file at South Operations Center, Redwood National and State Parks, Orick, CA. 61pp.
- Weckerly, F. W., McFarland, K. A., Ricca, M. A., and Meyer, K. P. 2004. Cropping rates, social affinity and sexual segregation in Roosevelt elk when population density changes. *American Midland Naturalist* 152.

PERSONAL COMMUNICATION

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Appendix A

Highest reliable (ranking <3) cow counts for identified elk herds, 1997 to 2011 (data displayed, in part, in Figure 1 in the report). ND = no data available for that year.

Location	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
OSOC	16	14	13	13	9	8	11	10	10	10	10	10	12	9	12
LRCR	16	26	32	38	31	31	27	18	22	22	21	17	15	16	18
BAHI	45	98	62	104	54	35	26	241*	251*	278*	270*	244*	261*	225*	241*
DARA	34	42	31	39	24	29	29	25	17	16	16	19	15	23	21
EPBY	21	21	15	20	19	9	5	6	5	4	5	2	3	0	0
GOBB	21	33	25	29	26	29	20	16	14	10	8	12	13	10	16
CBEC	ND	ND	ND	16	ND	23	ND	ND	30	ND	27	15	27	39	28

* Counts conducted using the “Weckerly method” account for differences in herd counts beginning in 2004.